FlexChassis™ ATCA 5U (6-Slot) DC User Manual

Document CC07261-01

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1 Safety

The intended audience of this User's Manual is system integrators and hardware/software engineers.

1.1 Safety Symbols used in this document

	Hazardous voltage! *This is the electrical hazard symbol. It indicates that there are dangerous voltages inside the Shelf.*

	Caution! ***This is the user caution symbol. It indicates a condition where damage of the equipment or injury of the service personnel could occur. To reduce the risk of damage or injury, follow all steps or procedures as instructed.***

	Danger of electrostatic discharge! *The Shelf contains static sensitive devices. To prevent static damage you must wear an ESD wrist strap.*

1.2 General Safety Precautions

	Warning! ***Voltages over 60 VDC can be present in this equipment. As defined in the PICMG 3.0 Specification, this equipment is intended to be accessed, to be installed and maintained by qualified and trained service personnel only.***

- Service personnel must know the necessary electrical safety, wiring and connection practices for installing this equipment in a telecommunication environment.
- Install this equipment only in compliance with local and national electrical codes.
- For additional information about this equipment, see the PICMG 3.0 Specification (www.picmg.com).

1.3 References and Architecture Specifications

- Pigeon Point Systems IPM Sentry Shelf-External Interface Reference (www.pigeonpoint.com)
- PICMG® 3.0 Revision 2.0 AdvancedTCA® Base Specification ECN-002 (www.picmg.com)

1.4 Product Definition

The FlexChassis™ 5U / 6-Slot AdvancedTCA is for Fault Tolerant/High Availability Applications. The chassis is designed to work with two redundant Shelf Managers that use Pigeon Point Systems ShMM500 and a Shelf Alarm

Panel (SAP). At least one Shelf Manager is needed for a working System.

1.5 Part Number

Part Number	Module
5-02468	FlexChassis™ ATCA 5U, 19", 6-slot, Dual Star, 2 PEMs, 2 Fan Tray Modules, 1 IPMI monitored air filter

The Shelf Managers and the Shelf Alarm Panel are not included with the Shelf

1.6 Terms and Acronyms

Table 1: Terms and Acronyms

Term	Definition
ATCA	Advanced Telecom Computing Architecture
Backplane	Passive circuit board providing the connectors for the front boards. Power distribution, management and auxiliary signal connections are supported
CDM	Chassis Data Module
Chassis	Enclosure containing subrack, Backplane, boards, cooling devices, PEMs, same as Shelf
CMM	Chassis Management Module, same as Shelf Manager
ECN	Engineering Change Notice
ESD	Electrostatic Discharge
ETSI	European Telecommunications Standards Institute
FRU	Field Replaceable Unit
IPMB	Intelligent Platform Management Bus
IPMC	Intelligent Platform Management Controller
IPMI	Intelligent Platform Management Interface
PCB	Printed Circuit Board
PEM	Power Entry Module
RTC	Real Time Clock
RTM	Rear Transition Module
SAP	Shelf Alarm Panel
Shelf	See Chassis
U	Unit of vertical pitch. 1 U = 1.75 inches = 44.45 mm
VRTN	Voltage Return

1.7 Platform Components

A typical platform consists of the following key components:

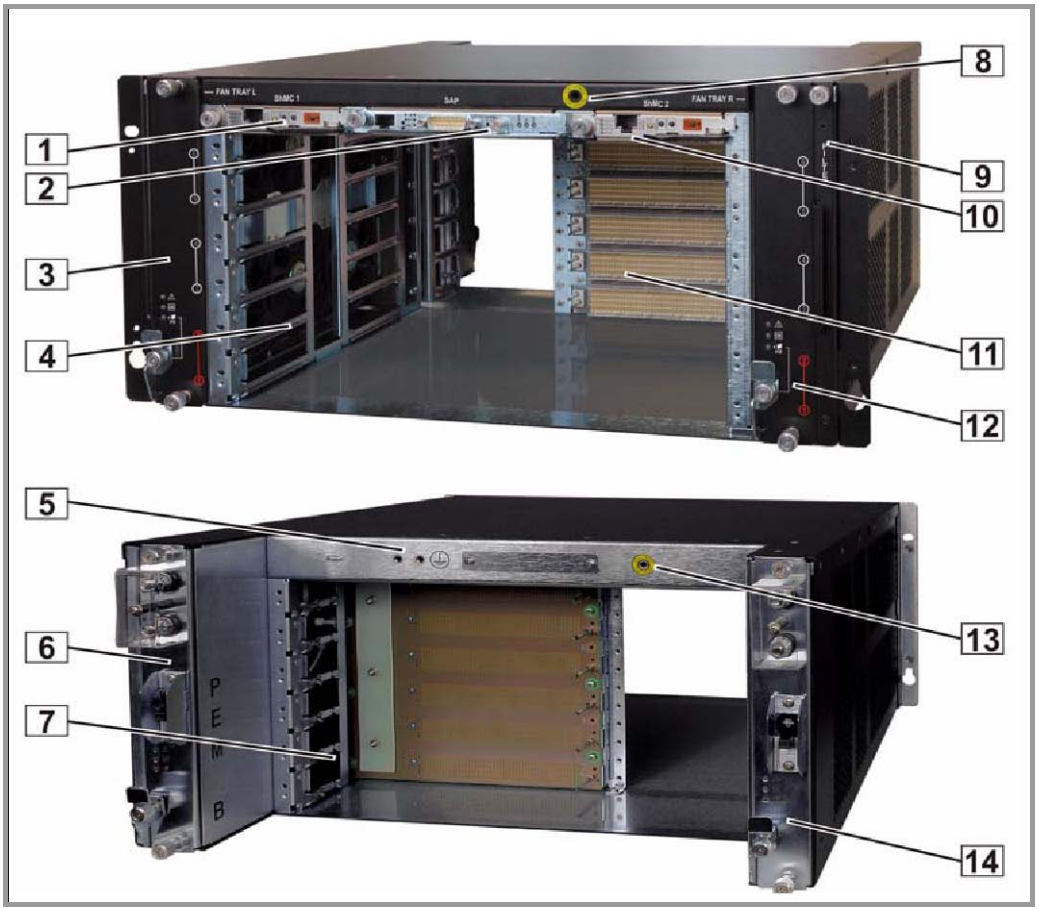
- Compliant to PICMG 3.0 Revision 2.0
- 6 slot ATCA Backplane with triple replicated Full Mesh Fabric Interface, Dual Star Base Interface and bused IPM interface, supporting four 8 U node board slots and two 8 U hub

slots

- Removable mounting brackets for 19“ cabinets (23“ and ETSI rackmounting kits optional)
- Additional fixing points for mid and rear mount options
- ESD Wrist Strap Terminals at the front and the rear
- 2 Dedicated Shelf Manager slots accepting ShMM-ACB-IV Shelf Managers
- Push-Pull Fan Tray arrangement provides optimized cooling for ATCA blades with fault tolerant capability
- 2 front pluggable IPMI enabled Hot Pluggable Fan Trays,
- Air inlet filter with presence monitoring
- Mounting provisions for front pluggable Shelf Alarm Panel (SAP): Provides Telco Alarm Connector, Alarm Status LEDs and serial interfaces for the Shelf Managers (IPM enabled or I2C enabled versions available)
- Two -48/-60 VDC IPMI enabled Power Entry Modules (PEMs) for redundancy

1.8 Chassis Front and Rear View

Figure 1: Chassis Front and Rear View



1	Slot for Shelf Manager 1	8	ESD Wrist Strap Terminal
2	Slot for Shelf Alarm Panel (SAP)	9	Air Filter
3	Fan Tray left	10	Slot for Shelf Manager 2
4	Front Card Cage	11	ATCA 6-Slot Backplane
5	Ground Terminal	12	Fan Tray right
6	PEM B	13	Rear ESD Wrist Strap Terminal

7	Rear Card Cage	14	PEM A

1.9 ESD Wrist Strap Terminals

Danger of electrostatic discharge!

The Shelf contains static sensitive devices. To prevent static damage you must wear an ESD wrist strap.

One ESD Wrist Strap Terminal is located at the upper front side and one ESD Wrist Strap Terminal is located at the upper rear side of the chassis.

2 ATCA Backplane

The 6-slot ATCA monolithic Backplane provides:

- 4 ATCA Node slots
- Two ATCA Hub slots
- Two Dedicated Shelf Manager slots. (Shelf Manager purchased separately)
- Two Power Entry Module (PEM) slots
- One slot for the Shelf Alarm Panel (SAP). (SAP purchased separately)
- Two slots for the Fan Trays
- One slot for the Chassis Data Module (CDM)

2.1 Logical to Physical Slot Mapping

The physical and logical slots are sequentially numbered from the lower to the upper side of the Shelf.

Table 2: 6-Slot ATCA Backplane physical to logical slot mapping

	Physical Slot	Logical Slot	HW-Address (Hex)	IPMB-Address (Hex)	Update Channel
Node	6	6	46	8C	
Node	5	5	45	8A	
Node	4	4	44	88	
Node	3	3	43	86	
Hub Slot	2	2	42	84	
Hub Slot	1	1	41	82	

2.2 Base Interface

Logical slots 1 and 2 are the hub slots for the Dual Star Base Interface. Base Interface Channel 1 (ShMC) of logical slot 1 and 2 is cross connected to both Dedicated Shelf Manager slots on the ATCA Backplane (as per PICMG 3.0 R2.0: ECN 3.0-2.0-001). See Chapter 2.10, "Shelf Manager Cross Connect" for details.

Table 3: Base Interface Interconnections

Connector	Base Ch.	Logical Slot					
		1	**2**	**3**	**4**	**5**	**6**
P23	1	ShMC	ShMC	1-3	1-4	1-5	1-6
P23	2	2-2	1-2	2-3	2-4	2-5	2-6
P23	3	3-1	3-2				
P23	4	4-1	4-2				
P23	5	5-1	5-2				
P23	6	6-1	6-2				

2.3 Fabric Interface

The Fabric Interface in the ATCA Backplane is routed as triple replicated Full Mesh with 3 Channels (24 differential pairs total), interconnecting each ATCA slot. See PICMG® 3.0 AdvancedTCA® Base Specification for details.

Table 4: 6 Slot Triple Replicated Mesh Fabric Interconnections

Connector	Fabric Channel	Logical Slot						
		1	2	3	4	5	6	
P20	15	6-11	6-12	6-13	6-14	6-15	5-15	MESH3
P20	14	5-11	5-12	5-13	5-14	4-14	4-15	
P20	13	4-11	4-12	4-13	3-13	3-14	3-15	
P21	12	3-11	3-12	2-12	2-13	2-14	2-15	
P21	11	2-11	1-11	1-12	1-13	1-14	1-15	
P21	10	6-6	6-7	6-8	6-9	6-10	5-10	MESH2
P21	9	5-6	5-7	5-8	5-9	4-9	4-10	
P21	8	4-6	4-7	4-8	3-8	3-9	3-10	
P22	7	3-6	3-7	2-7	2-8	2-9	2-10	
P22	6	2-6	1-6	1-7	1-8	1-9	1-10	
P22	5	6-1	6-2	6-3	6-4	6-5	5-5	MESH1
P22	4	5-1	5-2	5-3	5-4	4-4	4-5	
P22	3	4-1	4-2	4-3	3-3	3-4	3-5	
P23	2	3-1	3-2	2-2	2-3	2-4	2-5	
P23	1	2-1	1-1	1-2	1-3	1-4	1-5	

2.4 Synchronization Clocks

6 differential pairs of synchronization clocks are bused between all 6 ATCA slots and terminated at both ends with 80.6 Ohms between each differential pair.

2.5 Update Channel Interface

The Update Channels are wired between two redundant ATCA Backplane slots as 10 differential pairs with 100 Ohms impedance. (See Table 2)

The Update Channel is intended to pass information between two redundant ATCA Blades.

The Update Channel assignment is printed on the frontside of the Shelf.

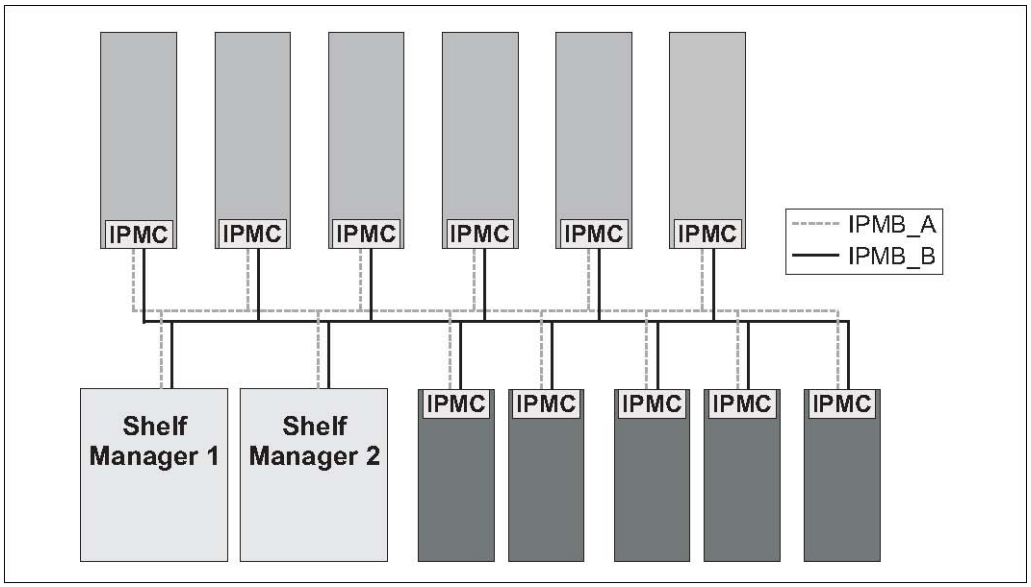
2.6 Intelligent Platform Management Bus (IPMB)

Definition: The Intelligent Platform Management Bus (IPMB) is an I²C-based bus that provides a standardized interconnection between different boards and FRUs within a Shelf.

In an ATCA Shelf two IPMBs are wired redundantly (IPMB-A and IPMB-B). In the FlexChassis ATCA 6-Slot Shelf IPMB-A and IPMB-B are routed to the ATCA slots, the Fan Trays, the PEMs and the SAP in a bused configuration.

Only the active Shelf Manager has access to the IPMB. (See Chapter 9.3, "Bused IPMB Interface")

Figure 2: Bused IPMB



2.7 Non-ATCA Connectors on the ATCA Backplane

Figure 3: ATCA Backplane front connectors

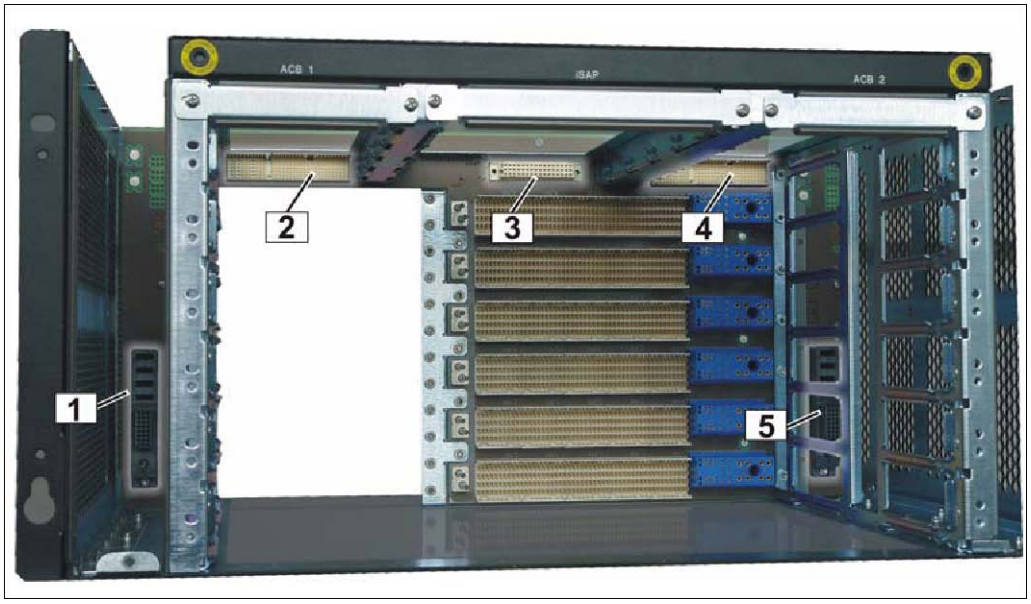
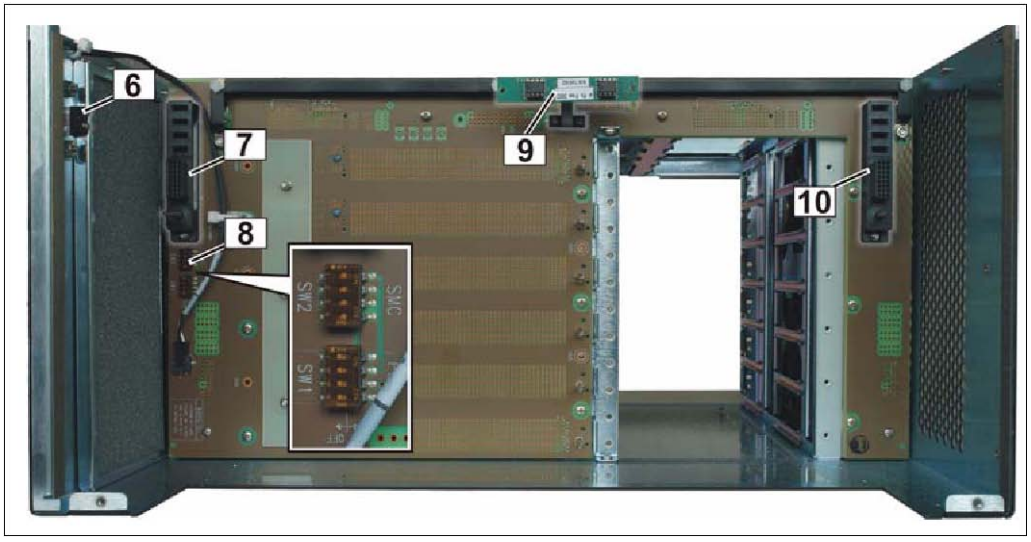


Figure 4: ATCA Backplane rear connectors



1	Fan Tray left Backplane Connector	6	Air Filter Presence Switch
2	Shelf Manager 1 Backplane Connector	7	PEM B Backplane Connector
3	SAP Backplane Connector	8	Microswitch Backplane SEEPROM
4	Shelf Manager 2 Backplane Connector	9	Chassis Data Module (CDM)
5	Fan Tray right Backplane Connector	10	PEM A Backplane Connector

2.8 Shelf Manager Backplane Connectors

The front accessible Shelf Manager slots accept Shelf Managers. The Backplane Connectors are wired to:

- IPMB-A and IPMB-B (I2C) to ATCA blades, Fan Trays, Power Entry Modules and Shelf Alarm Panel.
- Base Interface cross connections to the Hub Slots
- Presence connections to the Fan Trays and PEMs
- RS-232 and ShMC active connections to SAP
- Dedicated I2C to Shelf SEEPROMs (CDM)

The Shelf Manager Backplane Connectors also have interconnected signals that allow the Shelf Managers to run in a redundant configuration.

For Pin Assignment see Chapter 9.15, "Shelf Manager Front Panel and Backplane connectors".

2.8.1 PEM Backplane Connectors

For pin assignment see Chapter 7.9, "PEM Connectors and Indicators".

2.8.2 Fan Tray Connectors

For pin assignment see Chapter 6.5, "Fan Tray Connectors and Indicators".

2.8.3 SAP Connector

For pin assignment see Chapter 5.10, "SAP Connectors".

2.9 Shelf SEEPROM

The Shelf SEEPROM is a repository of the shelf specific information, capabilities of the system and other user configurable options.

The SEEPROM contains as example:

- a list of which slots are connected together
- how the update channels are routed
- how many slots are in the system
- what the maximum power is to each slot
- the serial number of the Shelf
- the backplane topology etc.

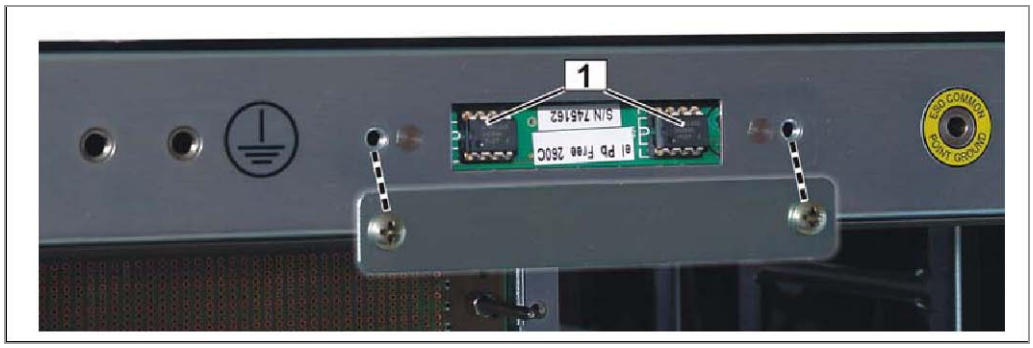
The Shelf Managers use this information to provide functions such as electronic keying, controlling the power state of the system, etc. The Shelf Managers cache the information that is stored in the SEEPROMs so that the SEEPROM is only needed when the Shelf Managers are first inserted or when the Shelf is first turned on. The redundant SEEPROMs ensure that if one is corrupt or non-functional, the second can provide the necessary information. The Shelf Manager selects what set of information is correct and then synchronizes the two SEEPROMs from the internally cached copy of the SEEPROM information.

2.9.1 Shelf SEEPROM Locations

There are two locations on the Shelf that the SEEPROMs resides. In the default configuration two redundant SEEPROMs are located on the Chassis Data Module (CDM). The CDM is a PCB at the upper rear side of the Shelf. The SEEPROMs are accessible through a removable panel. The hardware address for these SEEPROMs is 0xA4.

The SEEPROMs have the same address but are on different I²C-Channels!

Figure 5: CDM Slots



1 Chassis FRU SEEPROMs

The Shelf also provides for a secondary configuration with Chassis-SEEPROMs located on each PEM.

2.9.2 Access the Chassis SEEPROMS

The Shelf allows for 3 configurations of access to the SEEPROMs:

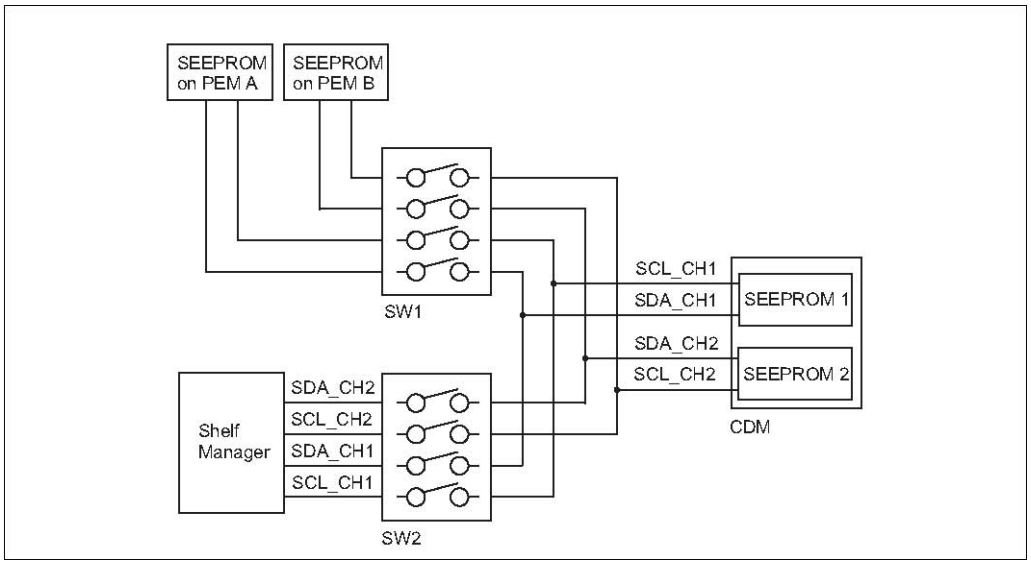
1 An I²C connection from each Shelf Manager to a SEEPROM on the CDM.

2 An IPMB connection from each Shelf Manager to a SEEPROM on the PEM.

3 An IPMB connection from each Shelf Manager to a SEEPROM on the CDM.
In this case the SEEPROMs on the CDM are connected to the internal I²C bus on the PEMs, the Shelf Manager has access to the SEEPROM via a IPMB connection to the PEM.

Options 2 & 3 can be used for Blade hosted System Management Systems. The connections are configurable by switches (SW1) and (SW2) on the Backplane.

Figure 6: SEEPROM Switches on Backplane



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Default configuration is SW2 closed and SW1 open. The Shelf Mangers have access via I²C-bus Channel 1 and Channel 2 to the SEEPROMs. In an alternative configuration SW2 is open and SW1 is closed so that the SEEPROMs on the CDM are connected to the internal I2C-bus on the PEMs. Now the Shelf Managers can access the SEEPROMs via IPMB.

2.9.3 Shelf SEEPROMs I²C addresses

CDM	Channel	I²C-bus address
CDM, SEEPROM1	Channel 0	0xa4
CDM, SEEPROM2	Channel 1	0xa4
PEM A, SEEPROM	Channel 0	0xa0
PEM B, SEEPROM	Channel 1	0xa0

2.10 Shelf Manager Cross Connect

The ATCA Backplane provides cross connect traces between the Base Hubs and the Shelf Managers according to PICMG Engineering Change Notice ECN 3.0-2.0-001. This ECN adds an option for dual 10/100 Base-T links from each Base Hub to both Dedicated Shelf Manager slots.

Figure 7: Shelf Manager Cross Connect

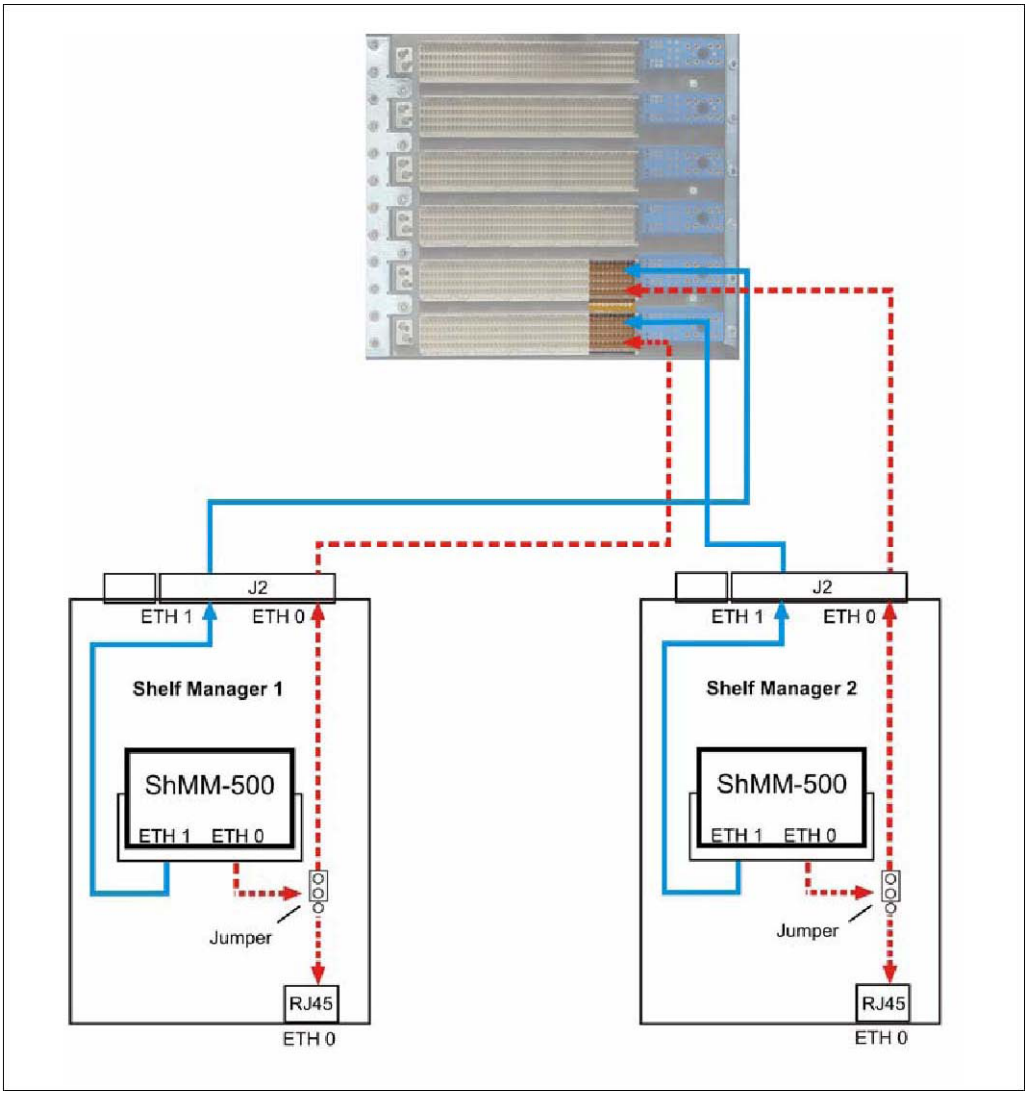

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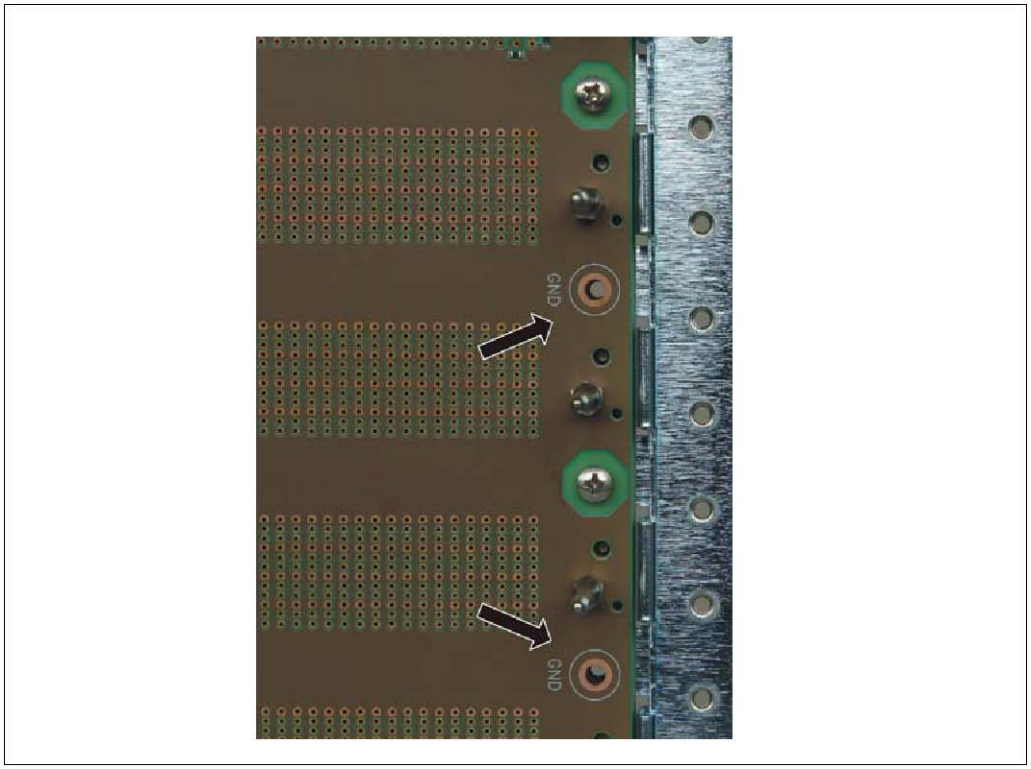
Table 5: Connector (P23) pin assignments for Shelf Manager Cross Connect

Row	Designation	ab		cd		ef		gh	
5	Shelf Manager Port with Shelf Manager Cross Connects	Tx1+	Tx1	Rx1+	Rx1	Tx2+	Tx2	Rx2+	Rx2
		Shelf Manager Cross Connect 1				Shelf Manager Cross Connect 2			

2.11 Logic Ground

Figure 8: Logic Ground



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The ATCA Backplane provides a mechanism to connect Logic Ground and Shelf Ground. To connect Logic Ground and Shelf Ground mount an additional backplane mounting screw (M3 x 12 mm) with an adequate washer at a position labeled with “GND“.

3 Air Filter

Figure 9: Air Filter

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1 Locking Screw
2 Air Filter
3 Air Filter Presence Switch

3.1 Introduction

The ATCA chassis provides a front replaceable air filter. The filter element is an open cell polyurethane foam special coating to provide improved fire retardation and fungi resistance.

The filter meets the requirements of the Telcordia Technologies Generic Requirements GR-78-CORE specification.

3.2 Air Filter Presence Switch

The air filter presence is detected by a micro switch located on the right side panel. The switch is accessible after removing PEM B.

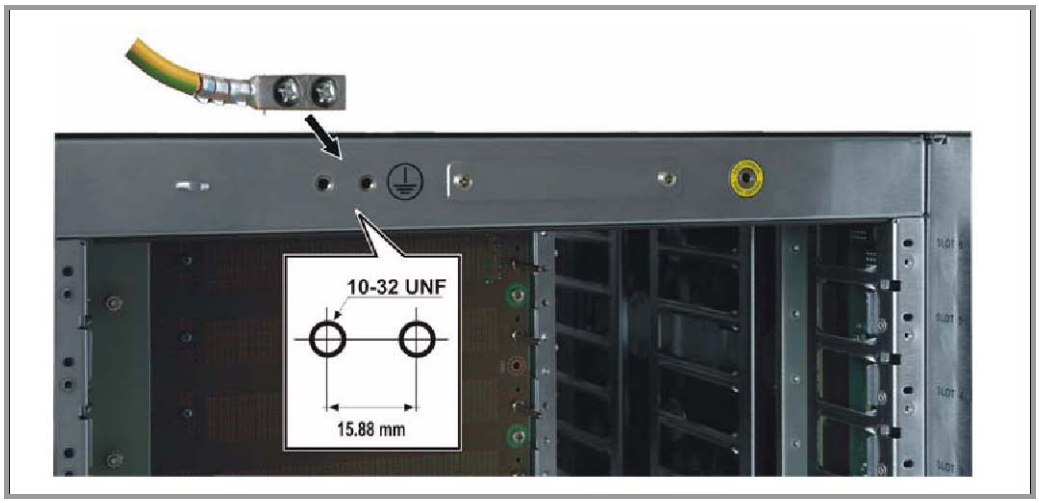
The micro switch is hosted by the PEM

4 Shelf Ground Connection

	Hazardous voltage! *Before powering-up the Shelf, make sure that the Shelf Ground terminals are connected to Protective Earth (PE) of the building.*

The ATCA chassis provides a Shelf ground terminal at the upper rear side. The Shelf ground terminal provides two threads (10-32 UNF) with a15.88 mm spacing between thread centers to connect a double-lug Shelf ground terminal cable.

Figure 10: Shelf Ground Terminal



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Please note, that in a typical telecom environment, the VRTN path of the -48 V supply is grounded to Protective Earth (PE) of the building.

4.1 Specification for the Shelf Ground connection cable

Required wire size: AWG10

Required terminals: Use only double lug terminals.

5 Shelf Alarm Panel

5.1 Introduction

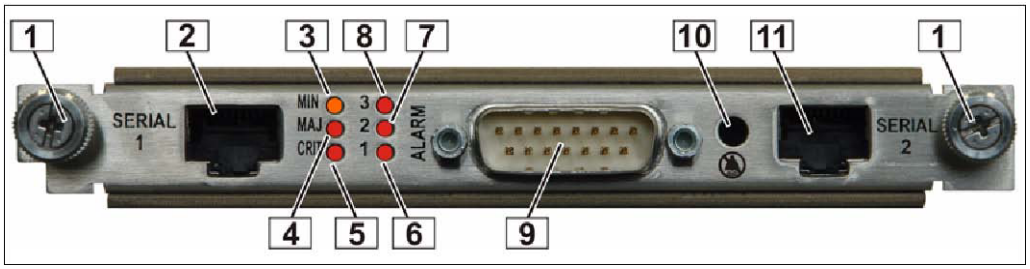
Some Shelf Manager I/O functionalities have been moved to a separate board called Shelf Alarm Panel (SAP). The Shelf Alarm Panel is located at the front top of the Shelf. It provides:

- 3 Shelf Alarm LEDs (MINOR, MAJOR, CRITICAL)
- The Telco Alarm connector (DB15-male)
- The Alarm Silence
- A serial console interface for Shelf Managers (RJ45 connector)

The I²C enabled DSAP can only be used together with Shelf Managers

5.2 DSAP

Figure 11: Front Panel DSAP



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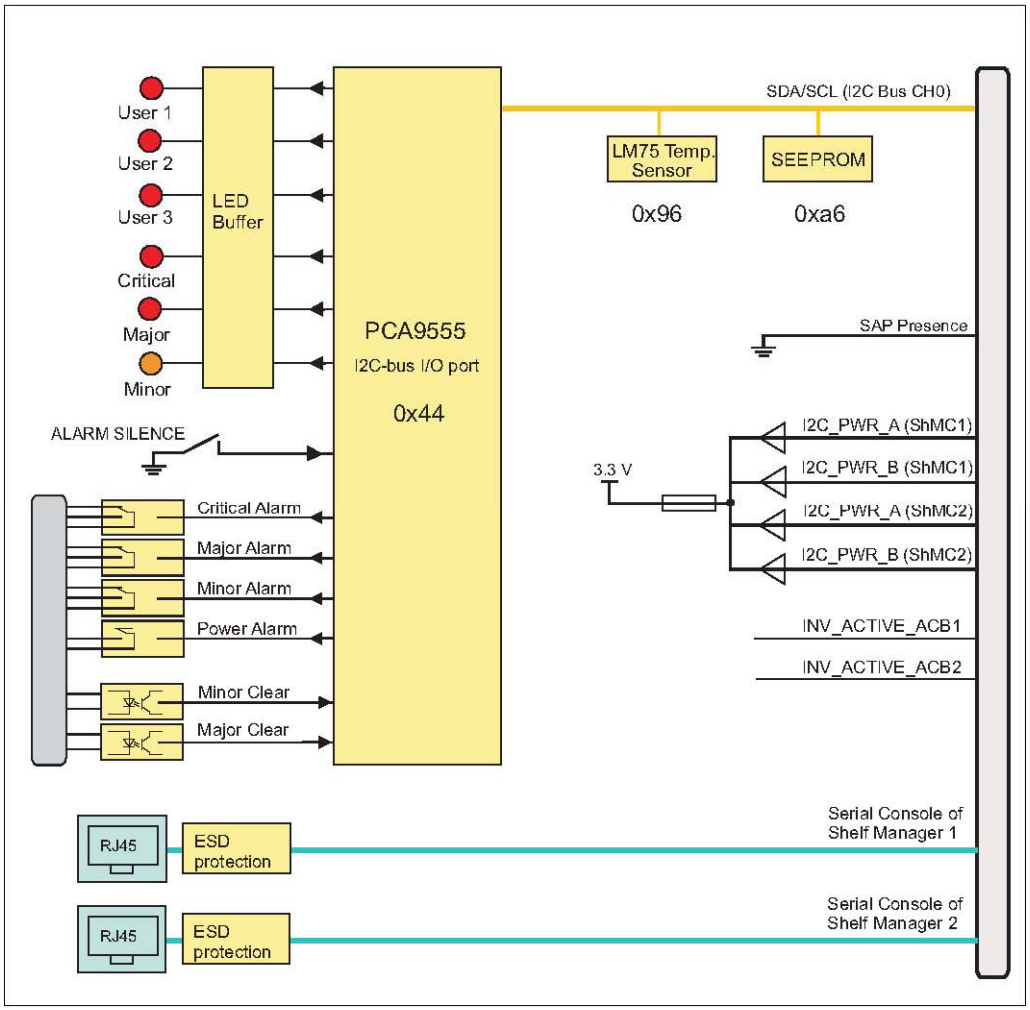
1	Fixing screw	7	LED USER 2
2	Serial Interface for Shelf Manager 1	8	LED USER 3
3	LED Minor Alarm (red)	9	Telco Alarm Connector
4	LED Major Alarm (red)	10	Alarm Silence button
5	LED Critical Alarm (amber)	11	Serial Interface for Shelf Manager 2
6	LED USER 1		

5.3 DSAP Block Diagram

Figure 12: DSAP Block Diagram



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5.4 DSAP SEEPROM

The SAP SEEPROM is connected to the Master-Only I²C-bus and is a Microchip 24LC256 device.

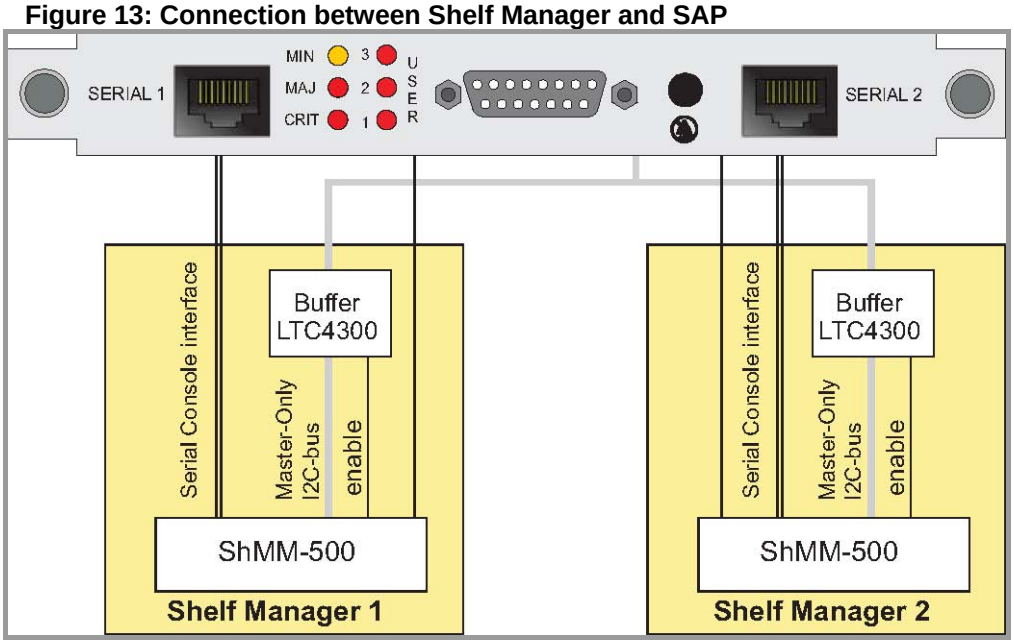
5.5 DSAP I²C Addresses

Table 6: DSAP I²C Addresses

LM75	SEEPROM	PCA9555
0x96/0x4b	0xa6/0x53	0x44/0x22

5.6 Connection between Shelf Manager and SAP

Figure 13: Connection between Shelf Manager and SAP



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5.7 SAP Telco Alarms

5.7.1 Telco Alarm Interface

The SAP provides a Telco Alarm interface on the DB15-male connector. Three relay outputs are used for remote alarm distribution, reflecting the state of the three Alarm LEDs. The relays are capable of carrying 72 VDC or 1 A with a max. rating of 30 VA.

5.7.2 Telco Alarm LEDs

The Shelf Alarm Panel provides the Telco Alarm LEDs. These LEDs indicate presence of Critical, Major and Minor alarms as follows:

Table 7: Telco Alarm LEDs

State	Description
Off	No alarm active
On	Alarm active
Flashing	Alarm active, but silenced

5.7.3 Alarm Silence Push Button

The Alarm Silence push button on the Shelf Alarm Panel faceplate deactivates the alarm relays. During the time Alarm Silence is activated, the Alarm LEDs flash. By pressing the Alarm Silence push button a second time, the alarm relays are reactivated and the Alarm LEDs are solid.

The **Alarm Silence** push button only activates the Alarm Silence state, but does not reset the alarms. If the silence interval (default 600 s) is exceeded without resolving the alarms, the alarms will be re-initiated.

5.7.4 Alarm Reset

Hardware Reset:

Two relay inputs at the DB15 connector are used to reset the Minor and Major alarm state.

The reset inputs accept timed pulse inputs for clearing Minor and Major alarm states. Reset is accomplished by asserting a voltage differential from 3.3 VDC to 72 VDC for between 200 ms and 300 ms. The acceptance voltage range is from 0 to 48 VDC continuous (handles up to 60 VDC at a 50% duty cycle). The current drawn by a reset input does not exceed 12 mA.

There is no hardware reset (reset input) for the Critical Alarm state.

Software Reset:

The RMCP and CLI functions can be used to set and reset the Telco Alarms (incl. Critical Alarm). See the Pigeon Point Shelf Manager External Interface Reference for more information.

5.8 SAP Connectors

5.8.1 SAP Telco Alarm Connector (DB15-male) Figure 16: Telco Alarm Connector

Figure 14: Telco Alarm Connector (DB15-male)

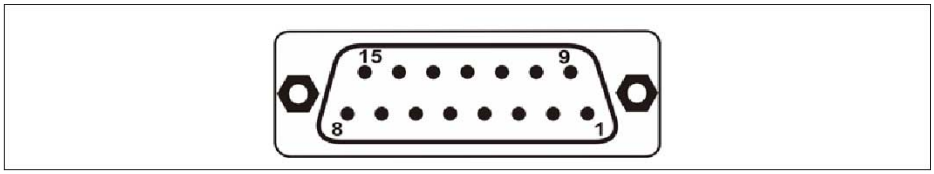

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Table 8: Telco Alarm Connector (CN2) Pin Assignment

CN2 Pin	Name	Description
1	AMIR+	Minor Reset+
2	AMIR-	Minor Reset
3	AMAR+	Major Reset+
4	AMAR-	Major Reset
5	ACNO	Critical Alarm - NO
6	ACNC	Critical Alarm - NC
7	ACCOM	Critical Alarm - COM
8	AMINO	Minor Alarm – NO
9	AMINC	Minor Alarm – NC
10	AMINCOM	Minor Alarm – COM

11	AMANO	Major Alarm – NO
12	AMANC	Major Alarm – NC
13	AMACOM	Major Alarm – COM
14	APRCO	Pwr Alarm – NO
15	APRCOM	Pwr Alarm - COM
Shield	Shelf-GND	Shelf Ground

5.8.2 Shelf Alarm Panel Backplane Connector

Figure 15: Shelf Alarm Panel Backplane Connector

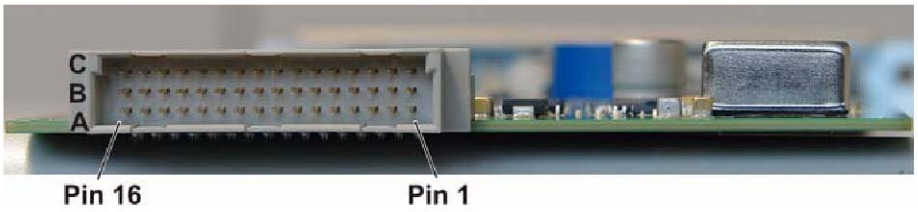

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Table 9: Shelf Alarm Panel Backplane Connector Pin Assignment

	SAP ATCA Backplane Connector					
Pin	**A**	**Description**	**B**	**Description**	**C**	**Description**
1	-48V_A	-48 V Feed A	-48V_B	-48 V Feed B		
2					VRTN_A	Voltage return Feed A
3					VRTN_B	Voltage return Feed B
4						
5			I2C_PWR_A (1)	3.6 V from Shelf Manager 1	I2C_PWR_B (1)	3.6 V from Shelf Manager 1
6	GND	Ground	GND	Ground	I2C_PWR_A (2)	3.6 V from Shelf Manager 2
7	SDA_CH0	Data I²C-bus Channel 0 (only DSAP)	GND	Ground	I2C_PWR_B (2)	3.6 V from Shelf Manager 2
8	SCL_CH0	Clock I²C-bus Channel 0 (only DSAP)	INT		GND	
9	INV_ACTIVE_B	Active signal from Shelf Manager 2 (right)	RXD0_ACB1	Receive Data Shelf Manager 1	RXD0_ACB2	Receive Data Shelf Manager 2
10	DSR_ACB1	Data Set Read Shelf Manager 1	DTR_ACB1	Data Terminal Ready Shelf Manager 1	DSR_ACB2	Data Set Ready Shelf Manager 2
11	CD_ACB2	Carrier Detect Shelf Manager 2	DTR_ACB2	Data Terminal Ready Shelf Manager 2	CD_ACB1	Carrier Detect Shelf Manager 1
12	CTS_ACB1	Clear To Send Shelf Manager 1	CTS_ACB2	Clear To Send Shelf Manager 2	RTS_ACB1	Request To Send Shelf Manager 1

13	TXD0_ACB2	Transmit Data Shelf Manager 2	TXD0_ACB1	Transmit Data Shelf Manager 1	SDA_B	Data IPMB_B (only ISAP
14	SDA_A	Data IPMB_A (only ISAP)	RTS_ACB2	Request To Send Shelf Manager 2	SCL_B	Clock IPMB_B (only ISAP
15	SAP_PRES	SAP Presence signal to Shelf Manager	SCL_A	Clock IPMB_A (only ISAP)		
16	INV_ACTIVE_A	Active signal from Shelf Manager 1(left)			SHELF_GND	Shelf Ground

5.9 SAP Temperature Sensor

The LM75 temperature sensor measuring the board temperature is located on the SAP PCB. The temperature sensor is either connected to the Master-Only I²C-bus (DSAP).

5.10 SAP PCA9555

The PCA9555 device:

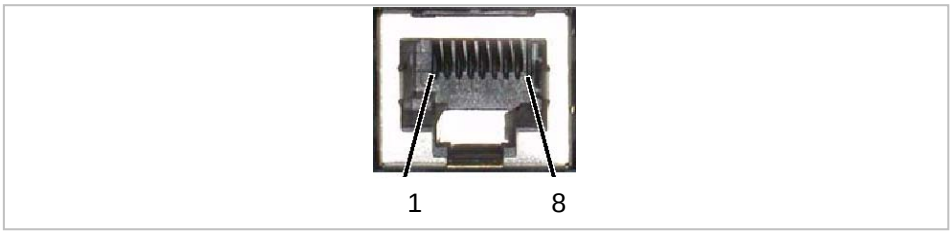
- controls the status of the LEDs
- reads the status of the Telco Alarm Cutoff push button
- controls the Telco Alarm relays

Table 10: PCA9555 Device Function

PCA9555 I/O pins	Function	State
0.0	Power Alarm to telco relays output	1 = relays powered
0.1	Minor Alarm to telco relays output	1 = relays powered
0.2	Major Alarm to telco relays output	1 = relays powered
0.3	Critical Alarm to telco relays output	1 = relays powered
0.4	N/C	Pulled High
0.5	LED_MIN (Minor alarm LED) output	1 = On
0.6	LED_MAJ (Major alarm LED) output	1 = On
0.7	LED_CRIT (Critical alarm LED) output	1 = On
1.0	Alarm Silence button input	0 = push button pushed
1.1	Minor Clear input	0 = voltage applied to input pins
1.2	Major Clear input	0 = voltage applied to input pins
1.3	N/C	Pulled High
1.4	N/C	Pulled High
1.5	LED_USER3 output	1 = On
1.6	LED_USER2 output	1 = On
1.7	LED_USER1 output	1 = On

5.11 RS-232 Serial Console Interface on Shelf Alarm Panel

Figure 16: RS-232 Serial Console Interface on Shelf Alarm Display



The Shelf Alarm Panel provides a RS-232 serial console connector for the Shelf Manager 1 and Shelf Manager 2. The connector is a 8-pin RJ45 modular receptacle.

The DSAP provides two RJ45 connectors.

A full set of RS-232 signals, including modem control is provided. The serial interface is implemented on the ShMM-500.

The RS-232 Serial Console Interface is available with EIA/TIA or Cisco pin assignment. The default configuration is Cisco pinout with:

- 115200 baud
- no parity
- 8 data bits
- 1 stop bit

Table 11: RS-232 Serial Connector Cisco Pin assignment (default)

RJ45 Pin	RS-232 Signal	Type	Description
1	RTS	Out	Request To Send
2	DTR	Out	Data Terminal Ready
3	TxD	Out	Transmit Data
4	GND	REF	Logic Ground
5	GND	REF	Logic Ground
6	RxD	In	Receive Data
7	DSR	In	Data Set Ready
8	CTS	In	Clear To Send

Table 12: RS-232 Serial Connector EIA/TIA Pin assignment

RJ45 Pin	RS-232 Signal	Type	Description
1	DSR	In	Data Set Ready
2	CD	In	Carrier Detect
3	DTR	Out	Data Terminal Ready

4	GND	REF	Logic Ground
5	RxD	In	Receive Data
6	TxD	Out	Transmit Data
7	CTS	In	Clear To Send
8	RTS	Out	Request To Send

5.12 SAP Console Cable for the Shelf Manger Serial Interface

Figure 17: RJ45 to DB9 Serial Console Cable Cisco option (default)

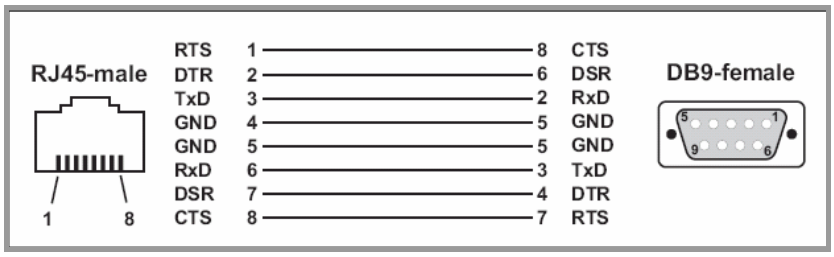


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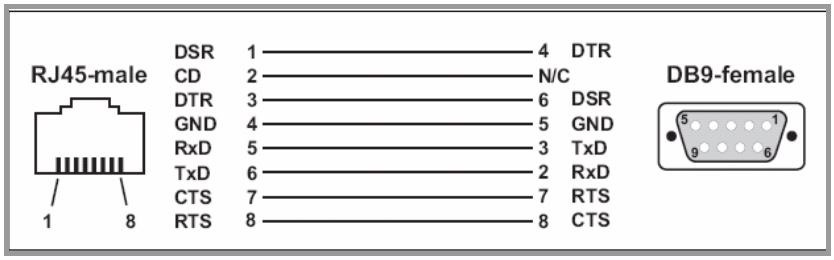
Figure 18: RJ45 to DB9 Serial Console Cable EIA/TIA option



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The connectors are shown with the cables pointing away.

The serial console cable is not included with the Shelf.

6 Fan Trays

6.1 Introduction

The Fan Trays are intelligent FRUs controlled by the Shelf Manager via IPMB.

The 6 Slot ATCA Shelf contains two interchangeable Fan Trays arranged in a side to side configuration for maximum air flow. The Fan Trays are plugged-in at the left and right front of the Shelf.

Each Fan Tray contains six high speed fans controlled as a group by the IPM Controller in the Fan Tray.

The Fan Tray is locked into the Shelf with two captive thumbscrews. An Injector/ Ejector handle that interfaces with a mechanical switch is used to provide hot-swap functionality. The handle has a captive thumbscrew that activates the hot-swap switch and locks the handle securely on the Fan Trays front panel.

The Shelf Managers monitor the Fan Trays through the two independent bussed IPMB connections.

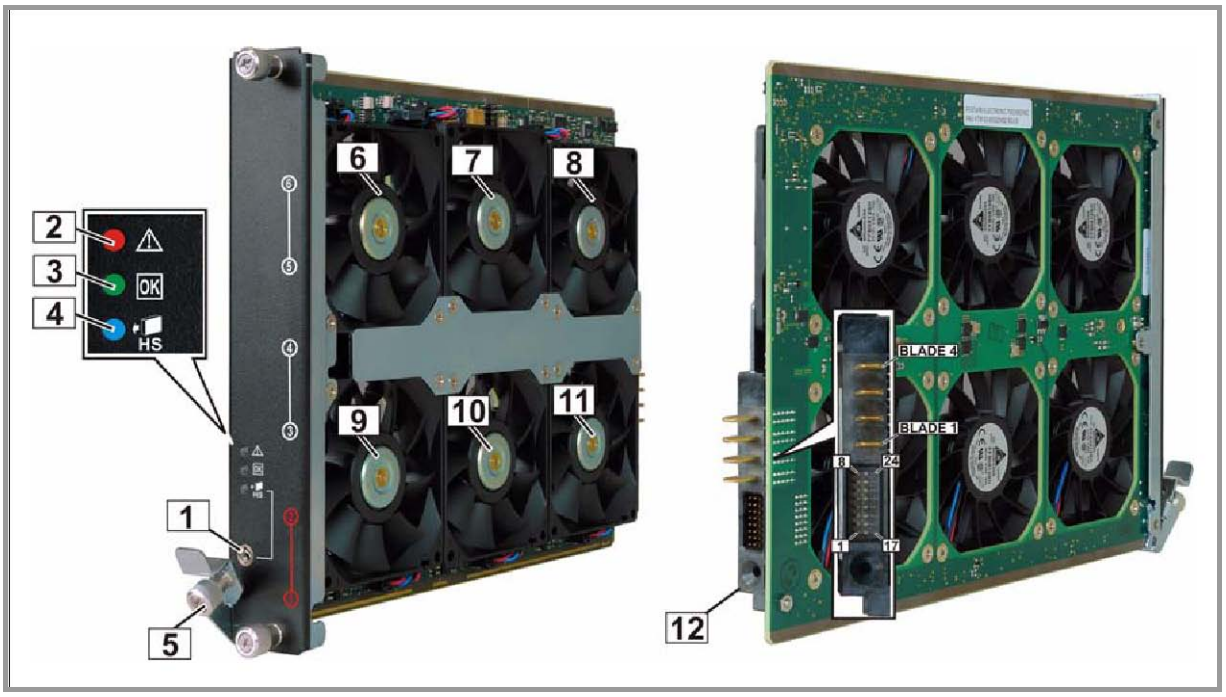
When the Fan Tray is first inserted into the system, the fans incrementally start at full speed and then decrease to 25% of full speed. The circuitry on-board the Fan Tray uses pulse-width modulation to control the speed of all the fans. Lower speeds reduce acoustic noise and increase the longevity of the fans.

The speed of each individual fan is monitored. If any of the fan speeds drops below or increases above the desired fan speed, a System Event Log (SEL) entry is logged by the Shelf Manager. The Shelf Manager then generates alerts and sets alarm conditions as necessary.

The system is designed to run indefinitely with any single fan failure. When one fan fails, all other fans are increased to full speed. The Fan Tray has sufficient cooling capacity to keep the Shelf cooled with a single fan failure.

Unlike the ATCA Blade FRUs, the Fan Tray does not negotiate for power with the Shelf Manager and it does not start out at Power Level 0 as specified in the PICMG 3.0 power management mechanism. This ensures that the fans start up immediately upon insertion.

Figure 19: Fan Tray, Front and Rear View



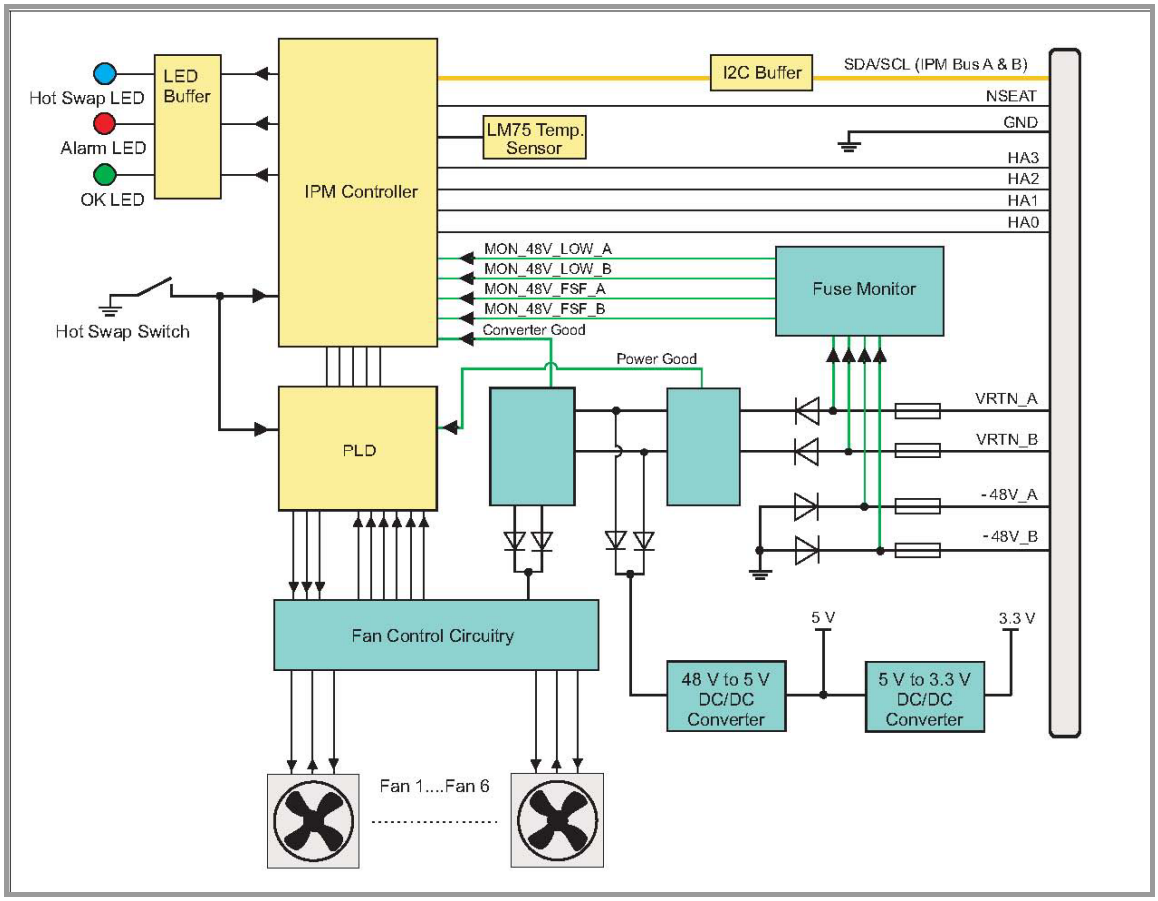
1	Hot Swap micro switch	7	Fan #2
2	Fan Tray Out Of Service LED (red)	8	Fan #3
3	Fan Tray In Service LED (green)	9	Fan #4
4	Hot Swap LED (blue)	10	Fan #5
5	Injector/Ejector handle	11	Fan #6
6	Fan #1	12	Backplane Connector

Table 13: Fan Tray Backplane Connector pin assignment

Pin #	Signal	Description	Pin #	Signal	Description
1	NSEAT	Seated Signal for IPM Controller, grounded on Backplane	13		
2			14		
3	SGND	Shelf Ground	15		
4			16	GND (Fan Presence)	Presence Signal for Shelf Manager
5			17	HA0	Hardware Address
6	SCL_A	IPMB-A Clock	18	HA1	Hardware Address
7	SCL_B	IPMB-B Clock	19	HA2	Hardware Address
8	GND	Logic Ground	20	HA3	Hardware Address
9			21	GND	Logic Ground
10	GND	Logic Ground	22	SDA_A	IPMB-A Data
11			23	SDA_B	IPMB-B Data
12			24	GND	Logic Ground
BLADE1	-48V_A	-48 VDC Feed A	BLADE3	-48V_B	-48 VDC Feed B
BLADE2	VRTN_A	RTN Feed A	BLADE4	VRTN_B	RTN Feed B

6.2 Fan Tray Block Diagram

Figure 20: Fan Tray Block Diagram



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6.3 Fan Tray Signals

The Fan Tray provides signals for:

- Voltage monitoring
- Status of the Hot Swap Controller
- Status of the 12 V DC/DC converter
- Fan Speed
- Temperature

These signals are controlled by the IPM Controller devices on the Fan Tray PCB. The Shelf Manager has access to these signals via IPMB.

Table 14: Fan Tray Sensors

Sensor Name	Description	Sensor #	Normal	Thresholds					
				Lower Critical	Lower Non-Criti-cal	Lower Non-Recover	Upper Non-Criti-cal	Upper Critical	Upper Non Recover

						able			able
Hot Swap	M State Information	0	M4	M1, M2, M3, M5, M6, M7					
IPMB Physical	IPMB Physical	1							
+3.3V	+3.3 V	12	3.3 V	+2.97	+3.135	2.91	+3.465	+3.63	3.7
+5.0V	+5 V	13	5.0 V	+4.5	+4.75	4.4	+5.25	+5.5	5.6
+12.0V	+12 V	14	12.0 V	+9	+10	8.03	+13.5	+14.5	15.52
LM60 Temp	Temperature Sensor	15	25	N/A	N/A	N/A	61.34	67.55	75.83
Fan 1	RPM	2	On	600					
Fan 2	RPM	3	On	600					
Fan 3	RPM	4	On	600					
Fan 4	RPM	5	On	600					
Fan 5	RPM	6	On	600					
Fan 6	RPM	7	On	600					
-48V fuse A	-48 V Fuse A	8	Asserted						
-48V fuse B	-48 V Fuse B	9	Asserted						
-48V rtn fuse A	RTN Fuse A	10	Asserted						
-48V rtn fuse B	RTN Fuse B	11	Asserted						

6.4 Fan Tray Temperature Sensor

The temperature sensors (LM60) in the Fan Trays measure the input and exhaust temperatures of the Shelf.

6.5 Fan Tray Connectors and Indicators

The front panel includes the following indicators:

- Green LED – “In-Service”
- Red LED – “Out of Service”
- Blue LED – “Hot-Swap”

The Hot-Swap switch indicates to the Shelf Managers that the Fan Tray is about to be removed. Its use is optional, but it is provided so that service personnel can be trained to look for a blue LED to be illuminated on any active component before removing it from the system. Once the operator releases the Hot-Swap switch, the Shelf Manager is informed of the pending extraction. When the Shelf Manager feels it is “safe“ to remove the Fan Tray, the blue Hot-Swap LED illuminates solid.

Table 15: LEDs on Fan Tray front panel

Color	Description	Status	Condition
Green	In-Service LED	Off Solid green	No Power to the Fan Tray Normal Operation
Red	Alarm LED	Solid red	Attention Status (error condition)

Blue	Hot Swap LED	Off Long blink Short blink Solid blue	In use Searching for Shelf Manager Preparing for extraction Ready to remove

6.6 Fan Tray IPMB Addresses

Geographic address pins (HA0, HA1, HA2, HA3) at the Fan Tray Backplane connector determine the hardware addresses of the devices.

Table 16: Fan Tray IPMB Addresses

Fan Tray left	0x5c
Fan Tray right	0x5a

7 Power Entry Module (PEM)

	Hazardous voltage! *Before working ensure that the power is removed from the power connection cables. When the system is powered on, do NOT touch the power terminals.*
	Warning! *Although there are fuses in the power entry circuit of the Shelf, the power lines have to be protected on rack level with 40 A breakers.*

The Shelf can be powered using a regular telecommunication power supply of -48 VDC / -60 VDC with a voltage return. The specified voltage range is from -40.5 VDC to -72 VDC.The Shelf supports redundant power sources but the two sources should be independently powered.

7.1 Introduction

The Power Entry Modules (PEMs) are intelligent FRUs controlled by the Shelf Manager via IPMB. Two pluggable redundant Power Entry Modules (PEMs) are located at the left and right rear side of the Shelf. The PEMs have an Injector/Ejector handle that interfaces with a mechanical switch and signals the IPM Controller for hot-swap. The handle has a captive thumbscrew that activates the hot-swap switch and locks the handle securely on the front panel.

Each PEM provides power terminals for a 40 A power feed. The power filtering consists of filtered power terminals and a discrete line-filter for each power input.

The PEM is controlled via an on-board IPM controller. The Shelf Manager performs management of the PEM through the two independent bussed IPMB connections. To indicate the Shelf Manager the presence of the PEM, a PEM presence signal is grounded by the PEM.

The PEMs are also responsible for cooling the RTM section of the Shelf. Three high speed fans per PEM provide an efficient airflow.

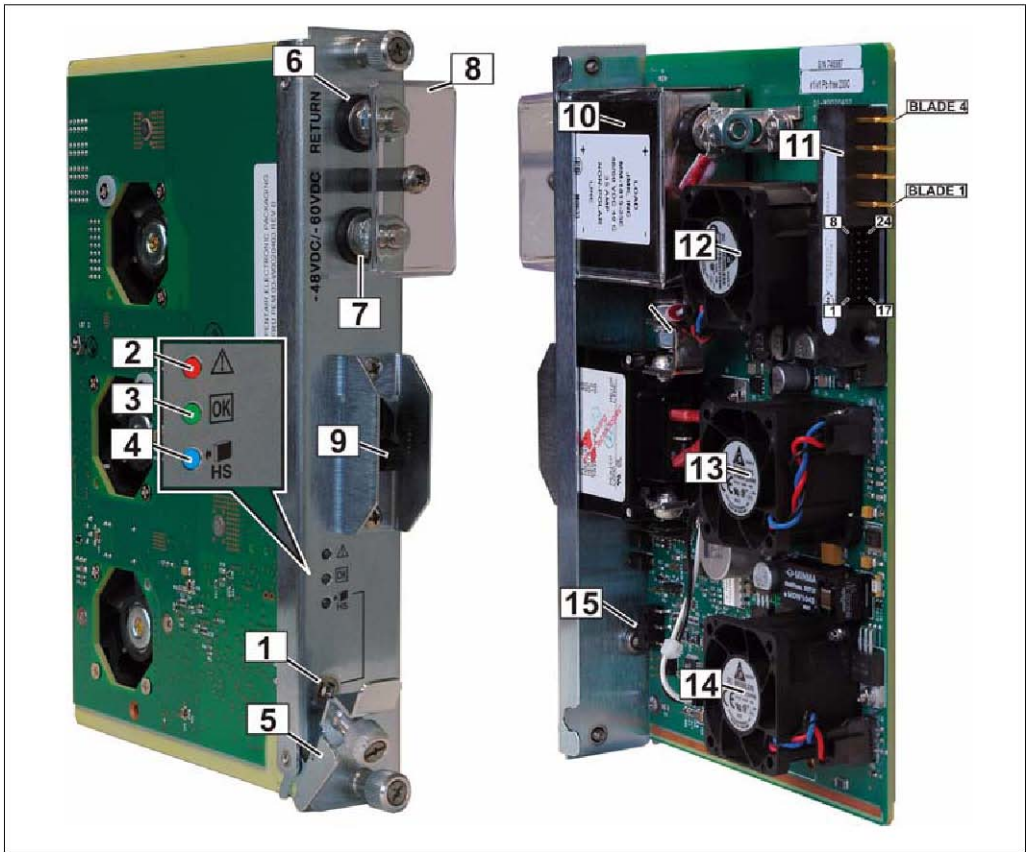
7.2 Input Terminal

Each power feed to the PEM consists of a –48 VDC cable and its corresponding return cable. The studs are ¼ in. studs (1/4“ - 20 UNC).

To prevent accidental shorting, a plastic housing covers the power feeds and returns.

7.3 PEM Components

Figure 21: PEM Components



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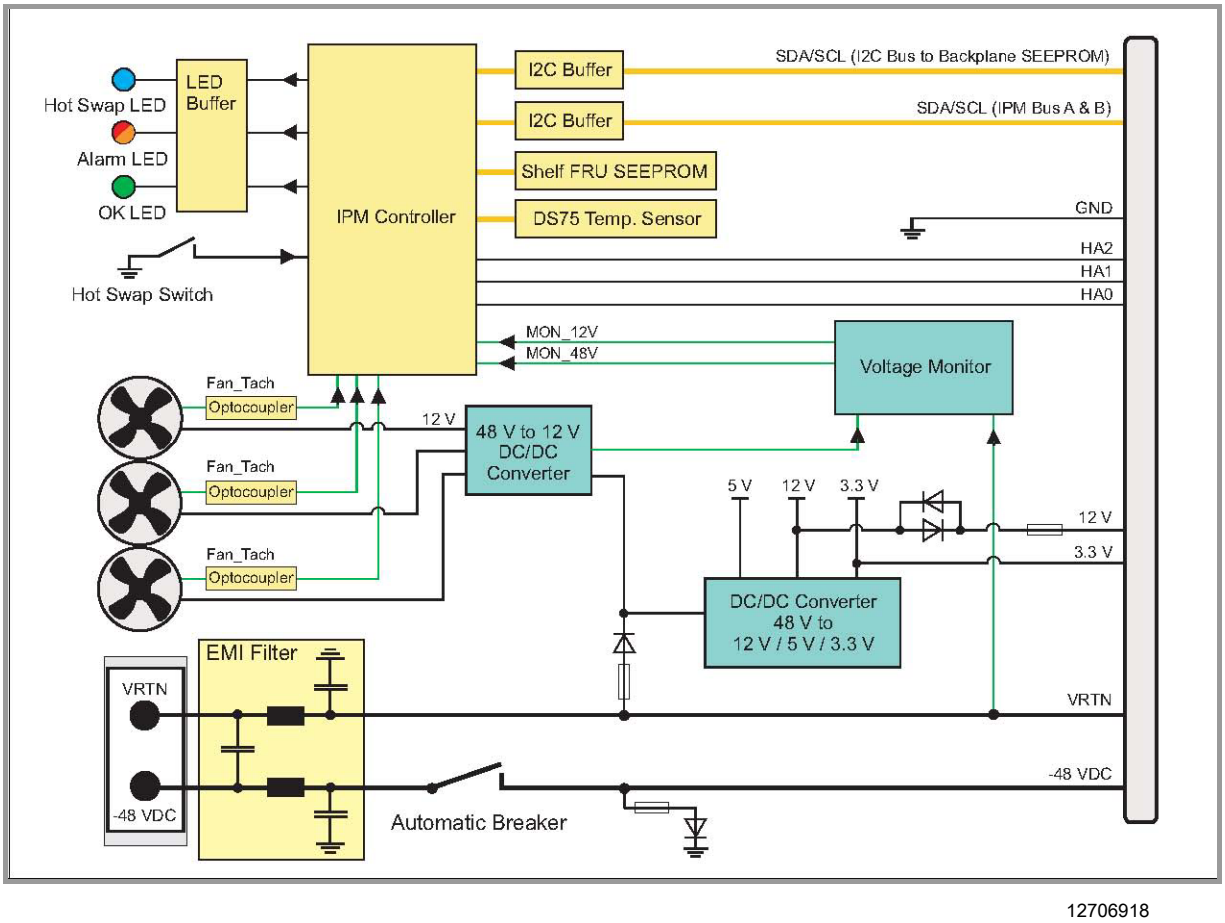
1	Hot Swap Switch Access	9	Circuit Breaker Switch
2	Out Of Service LED (red/amber)	10	EMI Filter
3	In Service LED (green)	11	Backplane Connector
4	Hot Swap LED (blue)	12	Fan#1
5	Injector/Ejector Handle	13	Fan#2
6	VRTN Terminal	14	Fan#3
7	-48/-60 VDC Terminal	15	Hot Swap Switch
8	Power Terminal cover		

7.4 PEM Block Diagram

Figure 22: PEM Block Diagram



7.5 PEM IPMB addresses

Geographic address pins (HA0, HA1, HA2) on the PEM Backplane connector determine the IPMB addresses of the PEM.

Table 17: PEM IPMB addresses

PEM Location	
PEM B (Right, view from front)	0x66
PEM A (Left, view from front)	0x68

7.6 Power Distribution

The power distribution within the Shelf originates from each PEM and powers all the blades, the Shelf Managers, the Fan Trays and the SAP. For maximum fault tolerance, the two PEMs should be independently powered by a separate Feed A and Feed B.

A single PEM is capable of supplying the 200 watts of power to each blade slot, the 15 Watts for each RTM slot and the necessary power for the Fan Trays and system management.

If two PEMs are in service, each PEM is hot-swappable after shut-off the PEM Circuit Breaker.

The PEM has two on-board power supplies. The first is a 48 V to 12 V DC/DC converter generating the power supply for the PEM fans. The second is a 48 V to 12 V / 5V / 3.3 V DC/DC converter generating the power supply for the IPM controller and other on-board devices.

The 12 V and the 3.3 V feeds are also routed to the Backplane connector.

- The 12 V feed is routed to the other PEM as backup power for the IPM controller. This configuration allows the Shelf Manager to communicate with both PEMs even if power is lost to one PEM.
- The 3.3 V feed is routed to the CDM connector on the Backplane to provide power to the Shelf SEEPROM.

7.7 Specification for the power connection cables

Required wire size:

Diameter 10 mm² resp. AWG8

max. length 2.5 to 3.0 m

suitable for 40 A at 50 °C ambient temperature.

7.8 PEM Signals

The PEM provides signals for:

- Voltage monitoring
- Status of the 48 to 12 V DC/DC converter (Fan Power)
- Fan Speed
- Temperature

These signals are controlled by the IPM Controller devices on the PEM PCB. The Shelf Manager has access to these signals via IPM-Bus.

Table 18: PEM Sensors

Sensor Name	Description	Sensor #	Normal	Thresholds					
				Lower Critical	Lower Non-Critical	Lower Non-Recoverable	Upper Non-Critical	Upper Critical	Upper Non-Recoverable
Hot Swap	M State Information	0	M4	M1, M2, M3, M5, M6, M7					
IPMB Physical	IPMB Physical	1							
+3.3V	+3.3 V	2	3.3 V	+2.97	+3.135	2.91	+3.465	+3.63	3.70
+5.0V	+5.0 V	3	5.0 V	+4.5	+4.75	4.43	+5.25	+5.5	5.70
+12.0V	+12.0 V	4	12.0 V	+9	+9.4	8.56	+12.6	+13.2	13.52
-48.0V	-48.0 V	11	-48.0 V	-72	-60	-73	-40	-36	-35
Fan Power(+12V)	Fan Power +12V	12	12 V	+10	+10.5	9.0	+13.0	+13.8	+14.0
DS75 Temp	Temperature Sensor	10	25	N/A	N/A	N/A	60	67	80

CB	Circuit Breaker	8	Asserted						
Fan Filter	Fan Filter	9	Inserted						
Fan 1	Fan 1 Speed	5	RPM	4000					
Fan 2	Fan 2 Speed	6	RPM	4000					
Fan 3	Fan 3 Speed	7	RPM	4000					

7.9 PEM Connectors and Indicators

The front panel includes the following indicators:

- Green LED – “In-Service”
- Bicolor Red and Amber LED – “Out of Service/Fan Failure”
- Blue LED – “Hot-Swap”

The PEMs have an Injector/Ejector handle that interfaces with a mechanical switch and signals the IPM Controller for hot-swap. Once the operator open the handle, the switch is released and the Shelf Manager is informed of the pending extraction. When the Shelf Manager feels it is “safe“ to remove the PEM, the blue Hot-Swap LED illuminates solid.

Table 19: LEDs on PEM front panel

Color	Description	Status	Condition
Green	In-Service LED	Off Solid green	No Power to the PEM Normal Operation
Red/Amber	Alarm LED	Solid red	Attention Status (error condition)
		Solid amber	-48 VDC Supply voltage not connected to the resp. PEM or Fan Failure on PEM
Blue	Hot Swap LED	Off Long blink Short blink Solid blue	In use Searching for Shelf Manager Preparing for extraction Ready to remove

Table 20: PEM Connector pin assignment

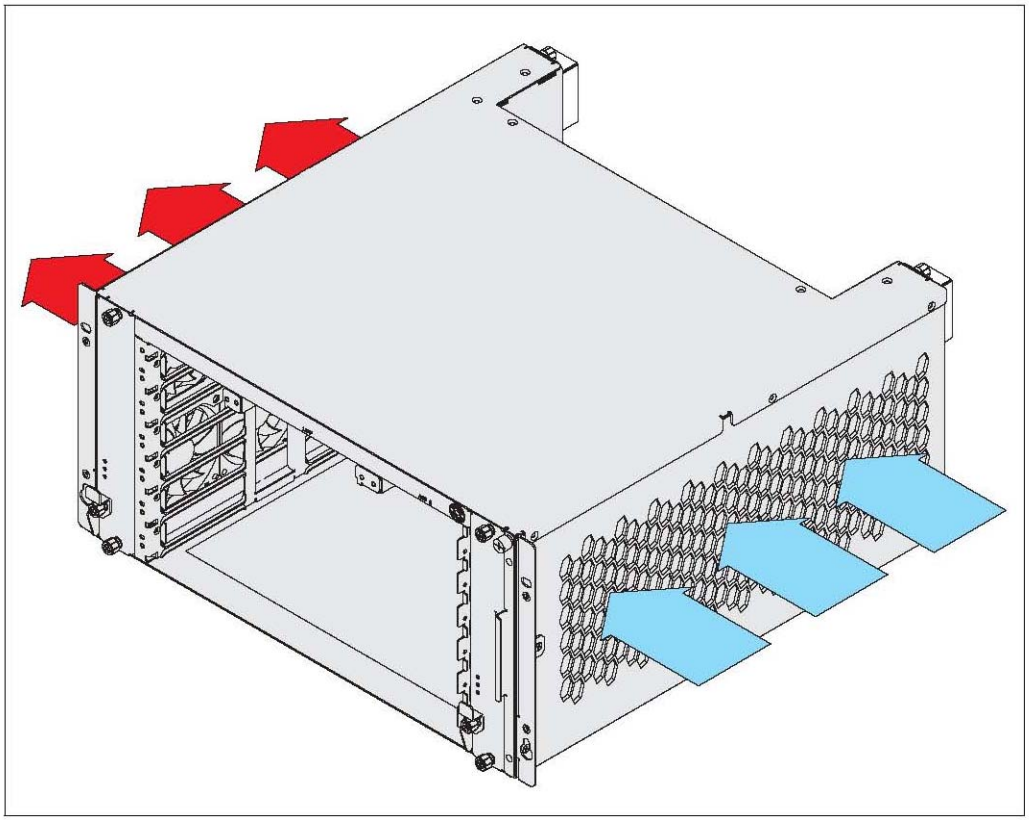
Pin #	Signal	Description	Pin #	Signal	Description
1			13	GND	Logic Ground
2	SDA_CH1/2	I2C Data for Shelf-SEEPROM on CDM	14	GND	Logic Ground
3	SCL_CH1/2	I2C Clock for Shelf-SEEPROM on CDM	15	SCL_A	IPMB A Clock
4	GND	Logic Ground	16	SDA_A	IPMB A Data
5	HA2	Hardware Address	17	SHELF_GND	Shelf Ground
6	HA1	Hardware Address	18		

7	HA0	Hardware Address	19	P12V_Y2	12 V for IPM Controller
8	FFP		20	GND	
9	SHELF_GND	Shelf Ground	21	PP (GND)	Presence Signal for Shelf Manager
10			22	GND	Logic Ground
11	P3V3	3.3 V for SEEPROM on CDM	23	SCL_B	IPMB B Clock
12	P3V3	3.3 V for SEEPROM on CDM	24	SDA_B	IPMB B Data
BLADE1	VRTN	VRTN Feed	BLADE3	-48 V	-48 VDC Feed
BLADE2	VRTN	VRTN Feed	BLADE4	-48 V	-48 VDC Feed

8 Thermals

The FlexChassis 5U (6-Slot) provides airflow using two Fan Trays at each side of the Blade subrack. Each Fan Tray has 6 fans moving air from the right side to the left side of the Shelf in a push-pull arrangement. This arrangement provides excellent airflow as well as fault tolerance in the unlikely event of a fan failure.

Figure 23: General airflow path for the 5 U 6 slot ATCA Shelf



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8.1 Typical Airflow Velocities through the slots

Figure 24: Front slot Air Velocities

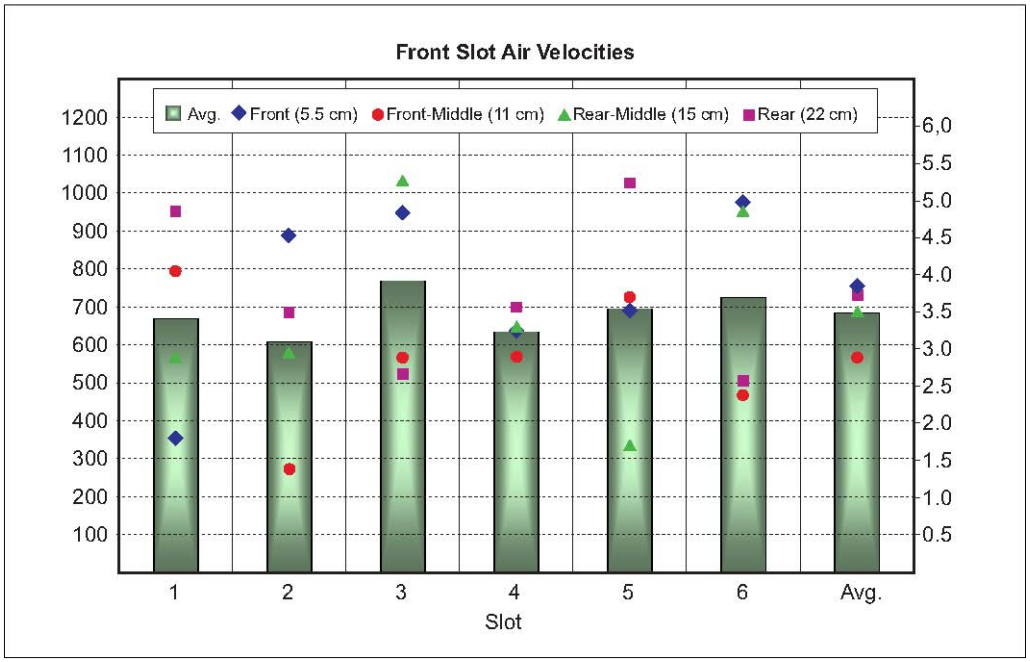

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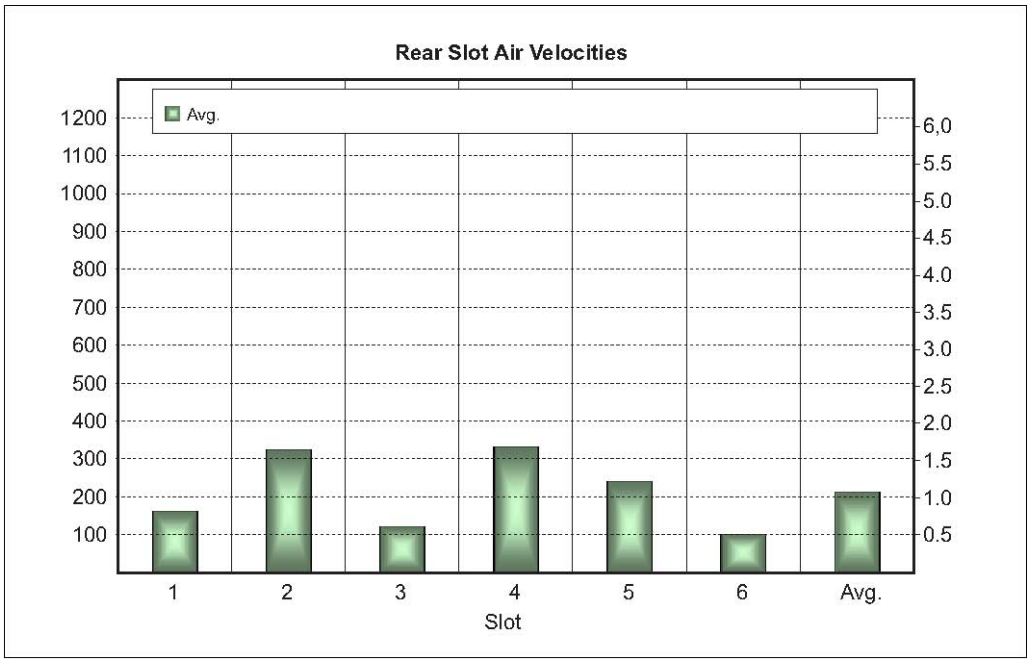
Figure 25: Rear slot Air Velocities



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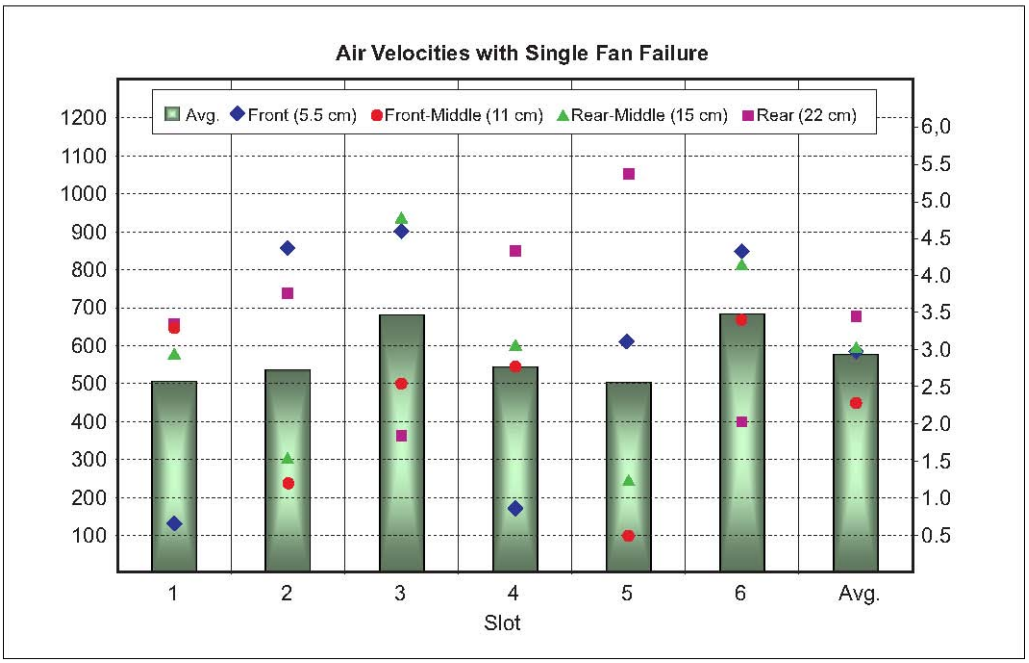
8.2 Air Velocities through slots with single fan failure

Figure 26: Air Velocities through slots with single fan failure



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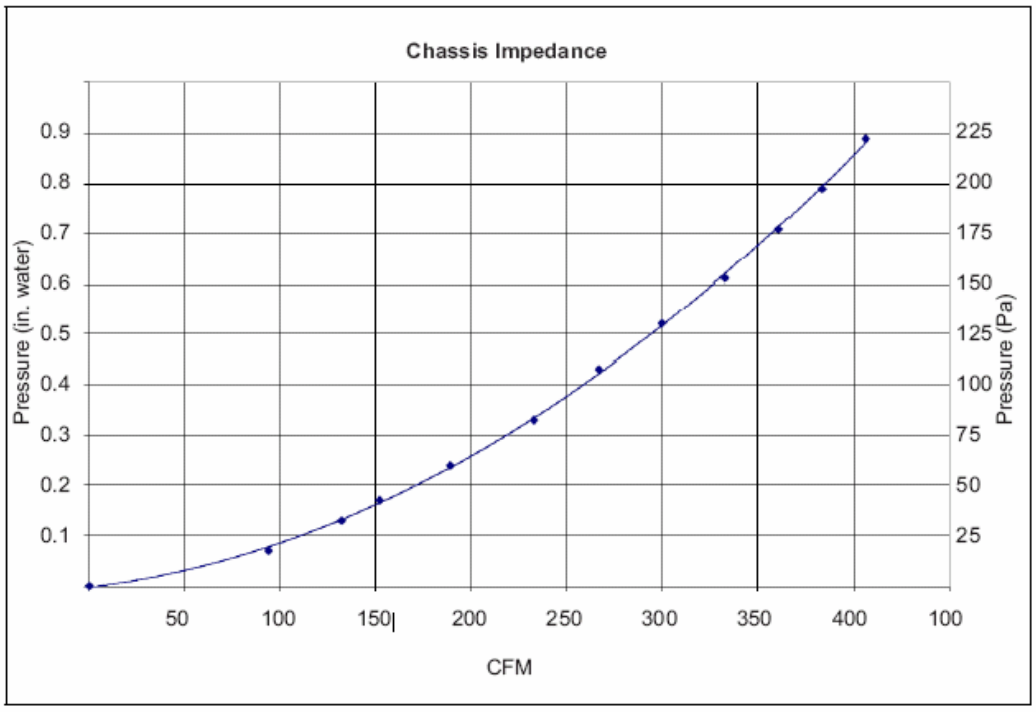
8.3 Chassis Impedance

Figure 27: Chassis Impedance



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8.4 Board Airflow Impedance

Figure 28: Front Board Airflow Impedance for ATCA Air Blocker Board

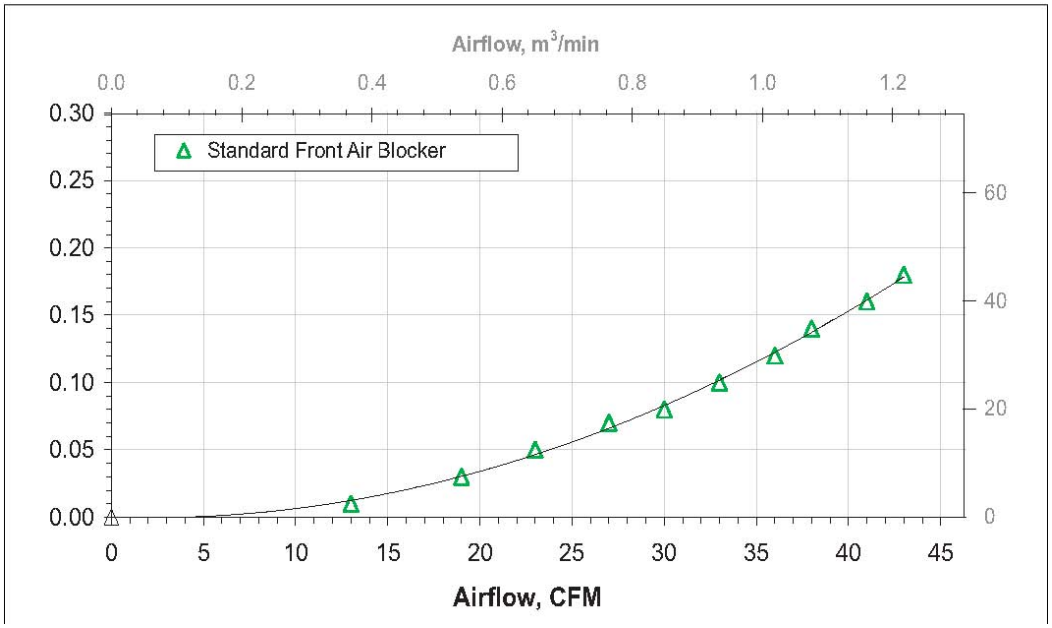

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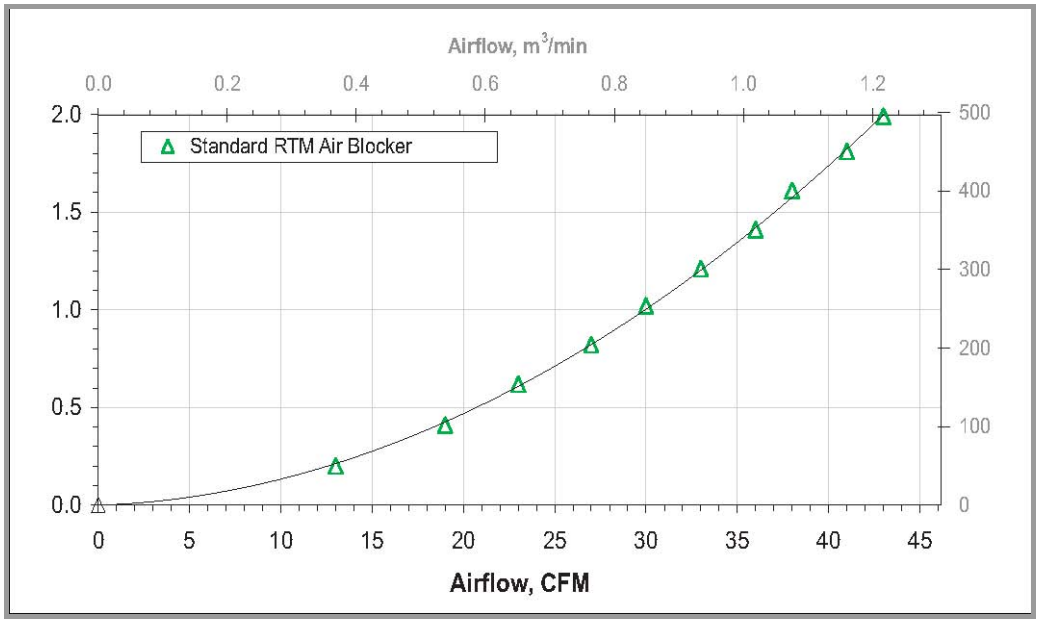
Table 21: Front Air Blocker Specifications

Obstruction height	Obstruction width (cross channel)	Blocked Area	Open Area	Slot Area	Percent Open	Percent blocked
19 mm	229 mm	4355 mm²	3468 mm²	7823 mm²	44%	56%

Figure 31: Rear Board Airflow Impedance for ATCA Air Blocker Board



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Board to Backplane gap sealed.

9 Shelf Manager

The Shelf Manager for ATCA 6- & 14-Slot DC-powered FlexChassis is a 78 mm x 280 mm board that fits into a dedicated Shelf Manager slot in an ATCA 12U, 14-Slot FlexChassis.

The Shelf Manager has two main responsibilities:

1. Manage/track the FRU population and common infrastructure of a Shelf, especially the power, cooling and interconnect resources and their usage.

2. Enable the overall System Manager to join in the management/tracking through the System Manager Interface, which is typically implemented over Ethernet.

The Shelf management based on the Pigeon Point Shelf management solution for ATCA products.

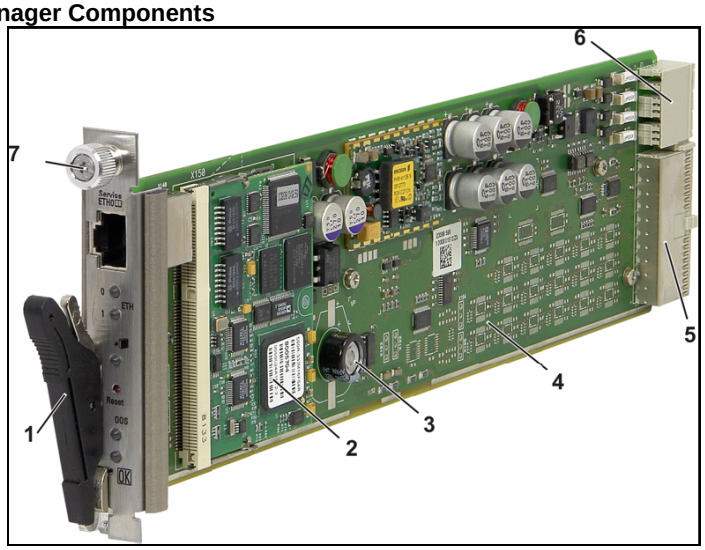
The Shelf management software executes on the Pigeon Point Shelf Management Mezzanine 500R (ShMM-500R), a compact SO-DIMM form-factor module, installed on the Shelf Manager Carrier board.

The Shelf Manager Carrier board includes several on-board devices that enable different aspects of Shelf management based on the ShMM-500R. These facilities include I²C-based hardware monitoring/control and GPIO expander devices.

The Shelf Manager Carrier board also provides the Fan Controller for up to 9 fans and individual Ethernet connections to both Base Hubs (ShMC cross connect), according to PICMG Engineering Change Notice ECN 3.0-2.0-001

The Shelf Manager communicates inside the Shelf with IPM controllers over the Intelligent Platform Management Bus (IPMB). The Shelf Manager also provides an IPMB interface for the non-intelligent FRUs in the ATCA 14-Slot FlexChassis. The Shelf Manager communicates with the non-intelligent FRUs over I²C busses and exposes the sensors for these FRUs at IPMB address 0x20.

Figure 29: Shelf Manager Components



1	Extraction handle	5	Backplane connector (J2)
2	ShMM 500R	6	Backplane connector (J1)
3	RTC backup capacitor	7	Fixing screw
4	Carrier board		

Please refer to the separate user manual for Shelf Manager for ATCA 6- & 14-Slot DC-powered FlexChassis for more details.

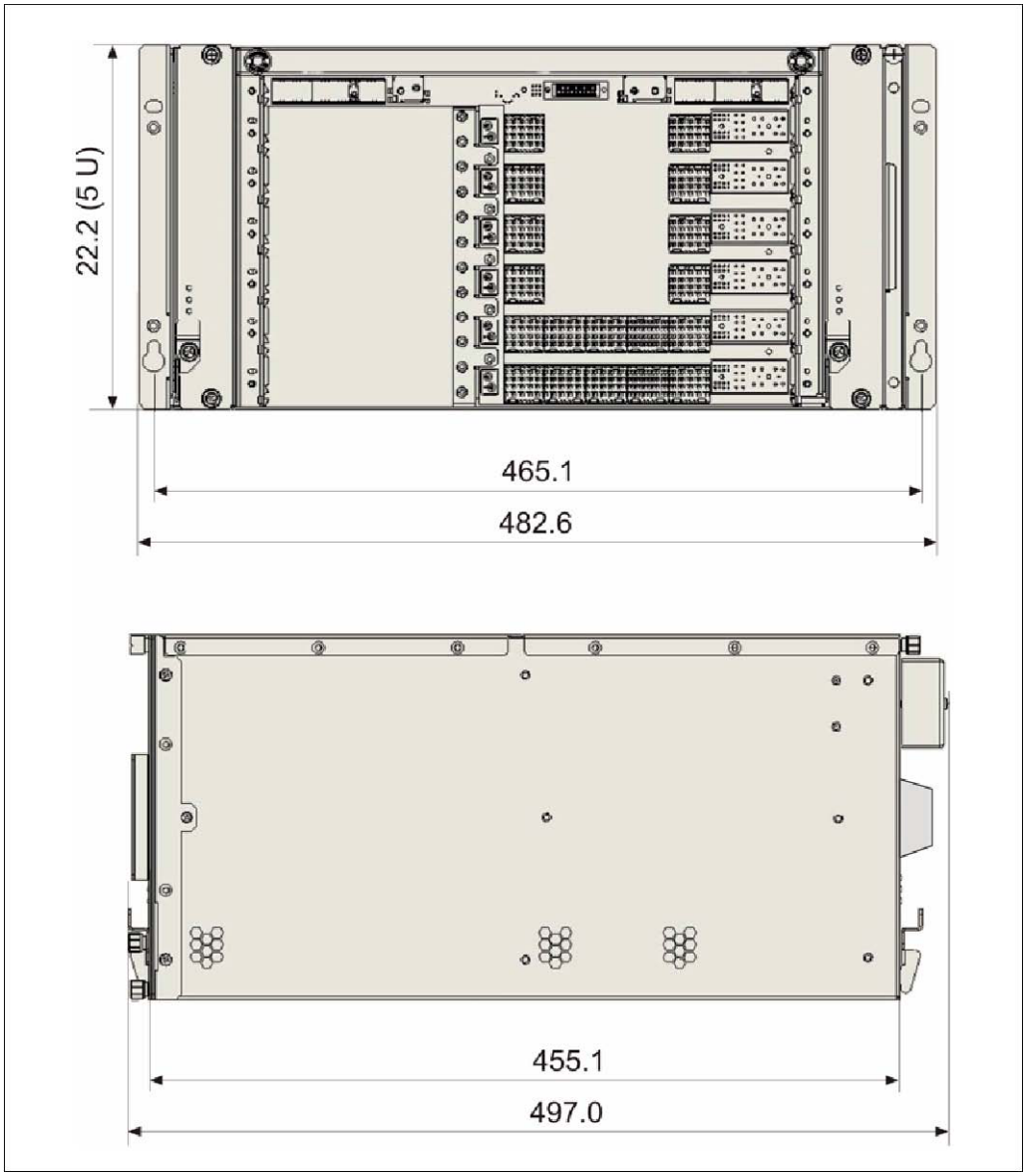
10 Technical Data

Table 22: Technical Data

Physical Dimensions	
Height	221.5 mm (5 U)
Width	448.2 mm (19“)
Depth (with PEM Covers and handles)	453.88 mm
Weight	
Shipping weight completely assembled with packaging	15.5 Kg
Shelf weight (w/o fan tray and w/o PEMs)	10.45 Kg
Shelf weight completely assembled	14.54 Kg
Power	
Input voltage	-40.5 VDC …. -72 VDC
Input Power	40 A per power feed
Overcurrent Protection	40 A Automatic Circuit Breaker on PEM
Cooling Capacity	
Front Boards	min. 200 W / Board
RTM	min. 30 W / Board
Power Consumption	
Shelf Manager	10W / Board
Fan Tray (x2)	120W at Full Speed
DSAP	10W
PEM	12W / each
EEPROM	1W
Environmental	
Ambient temperature	+5°C…+40°C (long term) -5°C…+50°C (short term)
Humidity	+5%...+85%, no condensation
EMI	
Conducted Emissions	EN 55022 Class A
Radiated Emissions	EN 55022 Class A
Safety	
Protected Earth Test	EN 60950, test current 25 A, resistance <100mOhm
Hipot Test	EN 60950, 1000 V

10.1 Shelf Mechanical Dimensions

Figure 30: Shelf Mechanical Dimensions



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